

# 6MBP15RH060

IGBT Modules

## IGBT-IPM R series

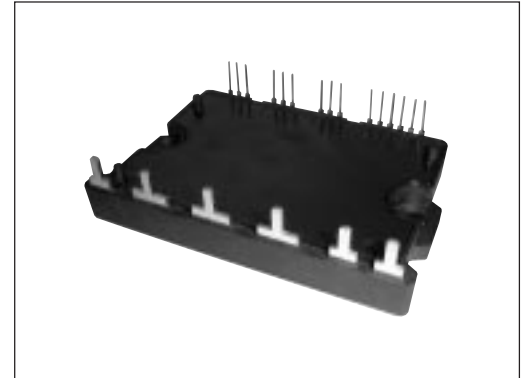
600V / 15A / 6 in one-package

### ■ Features

- Low power loss and soft switching
- High performance and high reliability IGBT with overheating protection
- Higher reliability because of a big decrease in number of parts in built-in control circuit

### ■ Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- UPS (Uninterruptible power supply)



### ■ Maximum ratings and characteristics

#### ● Absolute maximum ratings ( $T_c=25^\circ\text{C}$ unless otherwise specified)

| Item                                                          | Symbol           | Rating     | Unit             |   |
|---------------------------------------------------------------|------------------|------------|------------------|---|
| DC bus voltage                                                | $V_{DC}$         | 450        | V                |   |
| DC bus voltage (Surge)                                        | $V_{DC (surge)}$ | 500        | V                |   |
| DC bus voltage (Short operating)                              | $V_{SC}$         | 400        | V                |   |
| Collector-Emitter voltage                                     | $V_{CES}$        | 600        | V                |   |
| Collector current                                             | DC               | $I_c$      | 15               | A |
|                                                               | 1ms              | $I_{CP}$   | 30               | A |
|                                                               | Duty=44.1%       | $-I_c$     | 15               | A |
| Collector power dissipation                                   | One transistor   | $P_c$      | 40               | W |
| Junction temperature                                          | $T_j$            | 150        | $^\circ\text{C}$ |   |
| Input voltage of power supply for pre-driver                  | $V_{CC}$         | -0.3 to 20 | V                |   |
| Input signal voltage                                          | $V_{in}$         | $V_z$      | V                |   |
| Input signal current                                          | $I_{in}$         | 1          | mA               |   |
| Alarm signal voltage                                          | $V_{ALM}$        | $V_{CC}$   | V                |   |
| Alarm signal current                                          | $I_{ALM}$        | 15         | mA               |   |
| Storage temperature                                           | $T_{stg}$        | -40 to 125 | $^\circ\text{C}$ |   |
| Operating case temperature                                    | $T_{cop}$        | -20 to 100 | $^\circ\text{C}$ |   |
| Isolating voltage (Terminal to base, 50/60Hz sine wave 1min.) | $V_{iso}$        | AC 2500    | V                |   |
| Screw torque                                                  | Mounting (M4)    | 2.0        | N • m            |   |

#### ● Electrical characteristics of power circuit ( $T_c=T_j=25^\circ\text{C}$ , $V_{CC}=15\text{V}$ )

| Item                                  | Symbol         | Condition                            | Min. | Typ. | Max. | Unit |
|---------------------------------------|----------------|--------------------------------------|------|------|------|------|
| Collector current at off signal input | $I_{CES}$      | $V_{CE}=600\text{V}$ , $V_{in}$ open | -    | -    | 1.0  | mA   |
| Collector-Emitter saturation voltage  | $V_{CE (sat)}$ | $I_c=15\text{A}$                     | -    | -    | 2.7  | V    |
| Forward voltage of FWD                | $V_F$          | $-I_c=15\text{A}$                    | -    | -    | 3.5  | V    |

### ● Electrical characteristics of control circuit (T<sub>c</sub>=T<sub>j</sub>=25°C, V<sub>cc</sub>=15V)

| Item                                                 | Symbol               | Condition                           | Min. | Typ. | Max. | Unit |
|------------------------------------------------------|----------------------|-------------------------------------|------|------|------|------|
| Power supply current of P-line pre-driver (one unit) | I <sub>CCP</sub>     | V <sub>in</sub> =H                  | –    | 2.0  | 5.0  | mA   |
| Power supply current of N-line pre-driver            | I <sub>CCN</sub>     | V <sub>in</sub> =H                  | –    | 4.0  | 10.0 | mA   |
| Input signal threshold voltage                       | V <sub>in (th)</sub> | Turn-on                             | 1.00 | 1.35 | 1.70 | V    |
|                                                      |                      | Turn-off                            | 1.25 | 1.60 | 1.95 | V    |
| Input zener voltage                                  | V <sub>Z</sub>       | R <sub>in</sub> =20kΩ               | –    | 8.0  | –    | V    |
| IGBT chips overheat protection temperature level     | T <sub>joH</sub>     | Surface of IGBT                     | 150  | –    | –    | °C   |
| Hysteresis                                           | T <sub>jH</sub>      |                                     | –    | 20   | –    | °C   |
| Collector current protection level                   | I <sub>oc</sub>      | N-side, (N1-N2 open)                | 21   | 27   | 33   | A    |
|                                                      | V <sub>oc</sub>      | Between N1 and N2                   | 190  | 200  | 210  | mV   |
| OC detecting resistance value                        | R <sub>oc</sub>      |                                     | –    | 7.5  | –    | mΩ   |
| Protection delay time                                | t <sub>DOC</sub>     | T <sub>j</sub> =25°C Fig. 1, Fig. 2 | –    | 5.0  | 7.0  | μs   |
| Undervoltage protection level                        | V <sub>UV</sub>      |                                     | 11.0 | –    | 12.5 | V    |
| Hysteresis                                           | V <sub>H</sub>       |                                     | 0.2  | –    | 0.8  | V    |
| Alarm signal hold time                               | t <sub>ALM</sub>     |                                     | 1.0  | 2.0  | –    | ms   |

### ● Switching characteristics (T<sub>c</sub>=T<sub>j</sub>=25°C, V<sub>cc</sub>=15V)

| Item                             | Symbol           | Condition                                  | Min. | Typ. | Max. | Unit |
|----------------------------------|------------------|--------------------------------------------|------|------|------|------|
| Switching time (IGBT) See Fig. 3 | t <sub>on</sub>  | I <sub>c</sub> =15A, V <sub>DC</sub> =300V | 0.5  | –    | –    | μs   |
|                                  | t <sub>off</sub> | Inductive-Load                             | –    | –    | 3.5  | μs   |
| Switching time (FWD)             | t <sub>rr</sub>  |                                            | –    | –    | 0.5  | μs   |

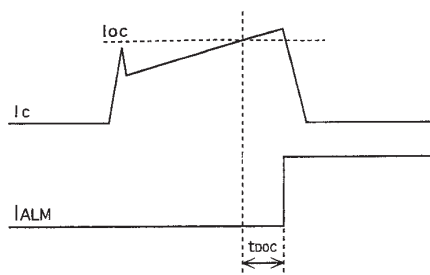


Fig.1 Definition of OC delay time

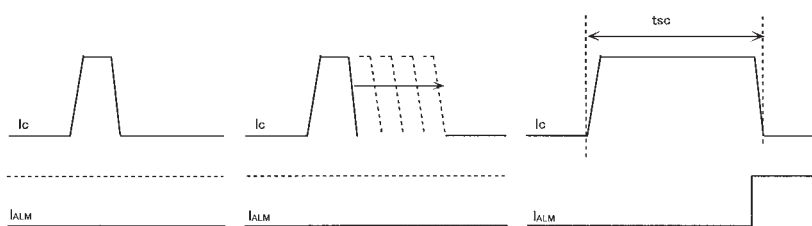


Fig.2 Definition of tsc

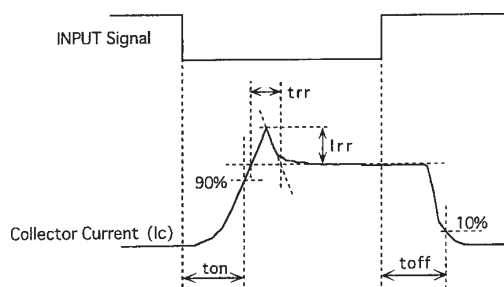


Fig.3 Definition of switching time

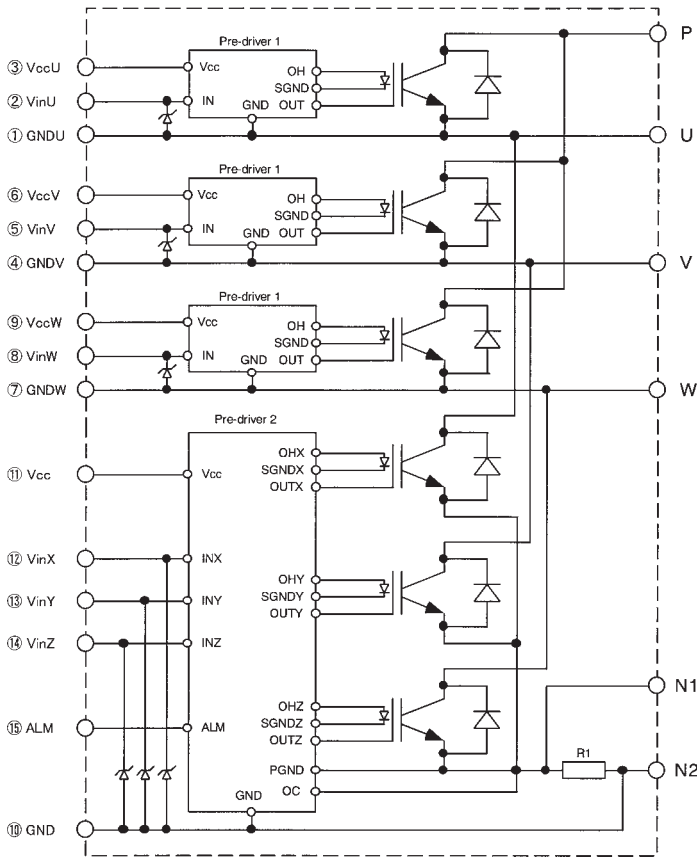
### ● Thermal characteristics (T<sub>c</sub>=T<sub>j</sub>=25°C, V<sub>cc</sub>=15V)

| Item                                         | Symbol                | Min.                  | Typ. | Max. | Unit |      |
|----------------------------------------------|-----------------------|-----------------------|------|------|------|------|
| Junction to case thermal resistance          | IGBT                  | R <sub>th (j-c)</sub> | –    | –    | 3.1  | °C/W |
|                                              | FWD                   | R <sub>th (j-c)</sub> | –    | –    | 5.4  | °C/W |
| Case to fin thermal resistance with compound | R <sub>th (c-f)</sub> | –                     | 0.05 | –    | °C/W |      |

### ● Recommendable value

| Item                                              | Symbol          | Min. | Typ. | Max. | Unit  |
|---------------------------------------------------|-----------------|------|------|------|-------|
| DC bus voltage                                    | V <sub>DC</sub> | 200  | –    | 400  | V     |
| Operating power supply voltage range of pre-drive | V <sub>CC</sub> | 13.5 | 15   | 16.5 | V     |
| Switching frequency                               | f <sub>sw</sub> | 1    | –    | 20   | kHz   |
| Flatness of heat sink                             | –               | –100 | –    | 100  | μm    |
| Mounting screw torque (M4)                        | –               | 1.3  | –    | 1.7  | N • m |

■ Block diagram



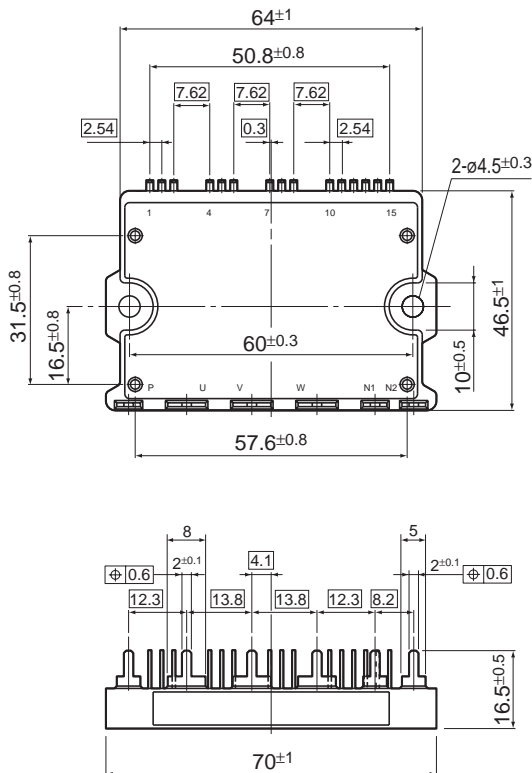
Pre-driver 1 includes following functions. (P-side)

- Amplifier for drive
- Power supply undervoltage protection
- IGBT chip overheating protection

Pre-driver 2 includes following functions. (N-side)

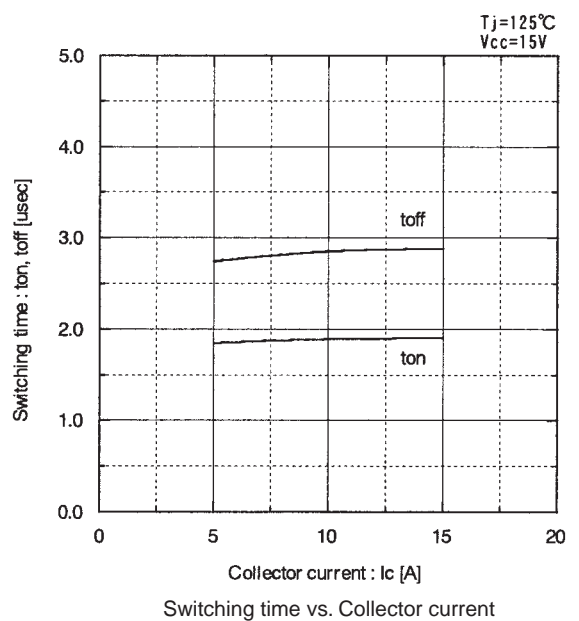
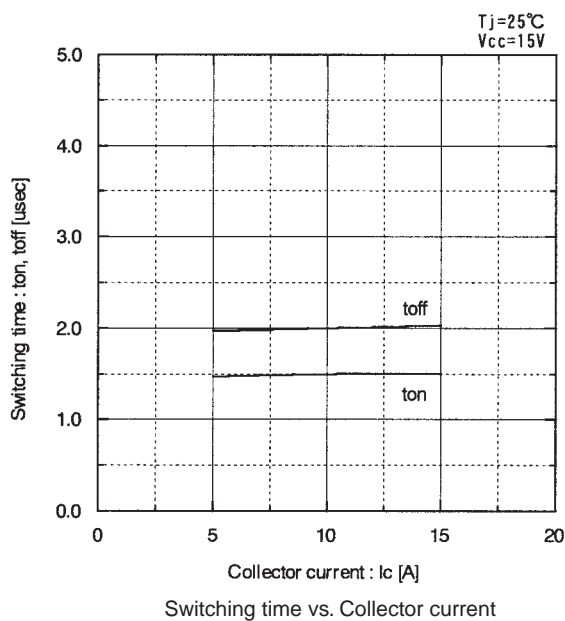
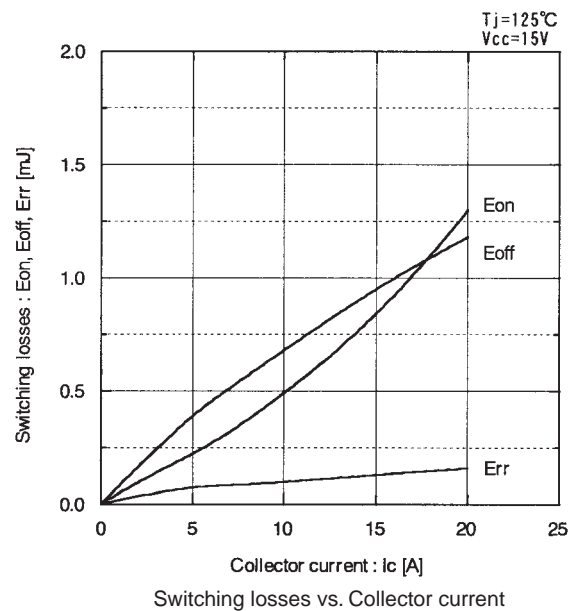
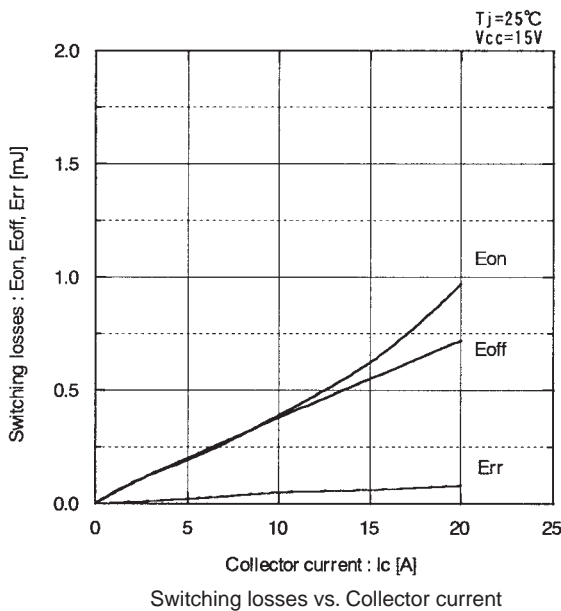
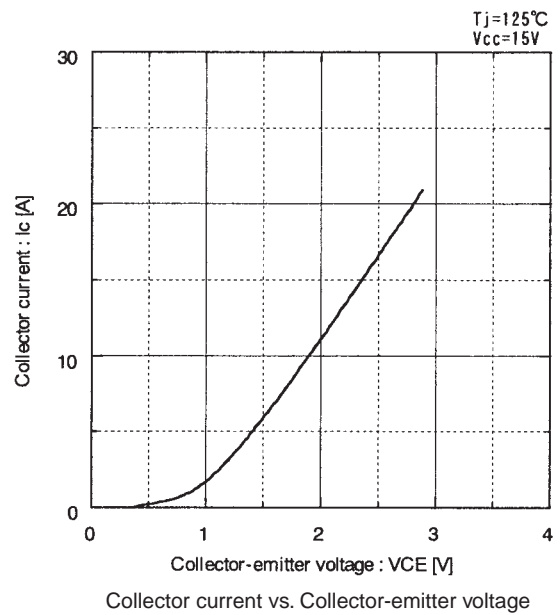
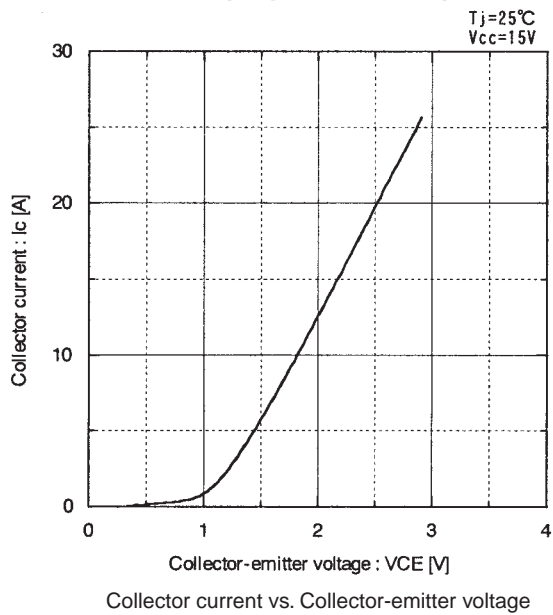
- Amplifier for drive
- Power supply undervoltage protection
- IGBT chip overheating protection
- Overcurrent protection
- Alarm signal output

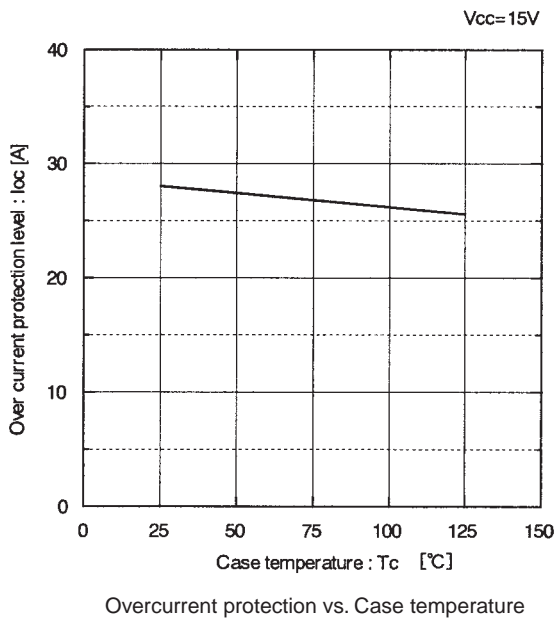
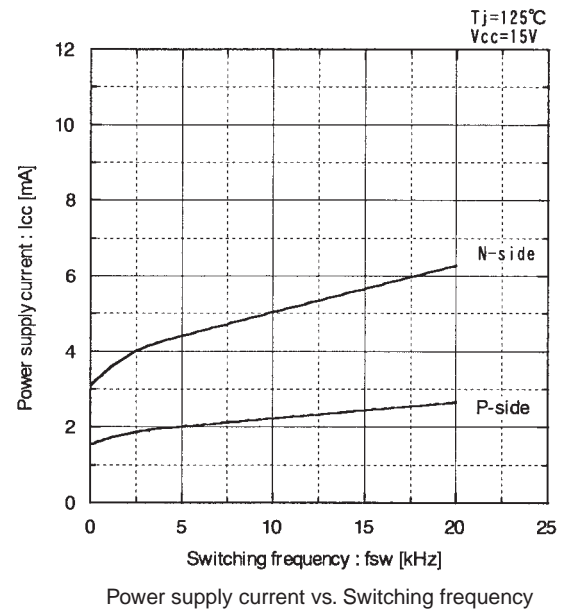
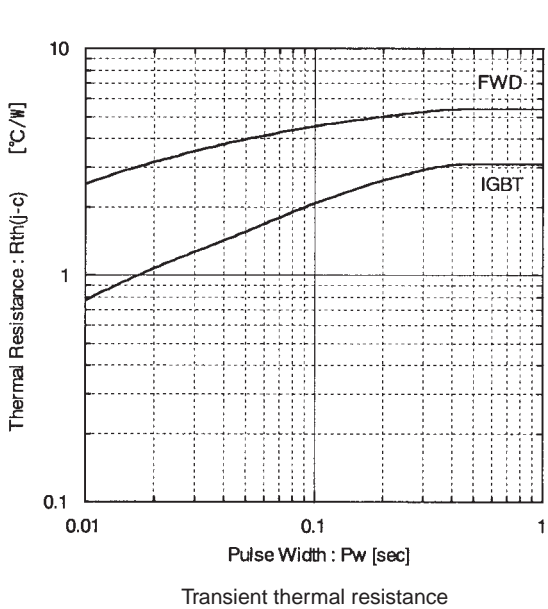
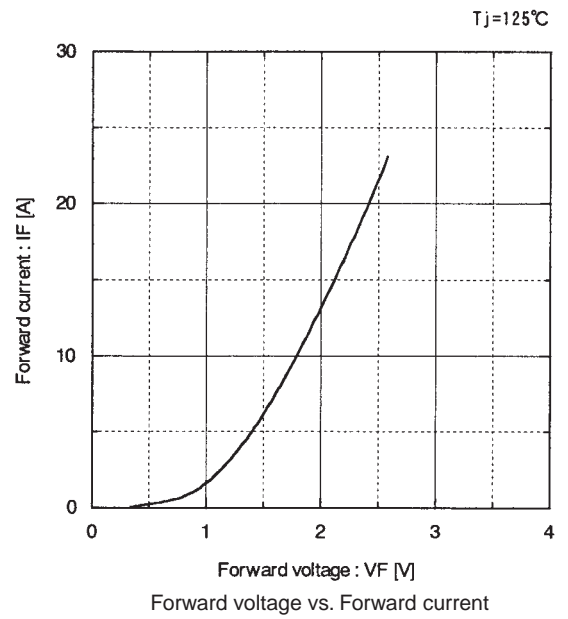
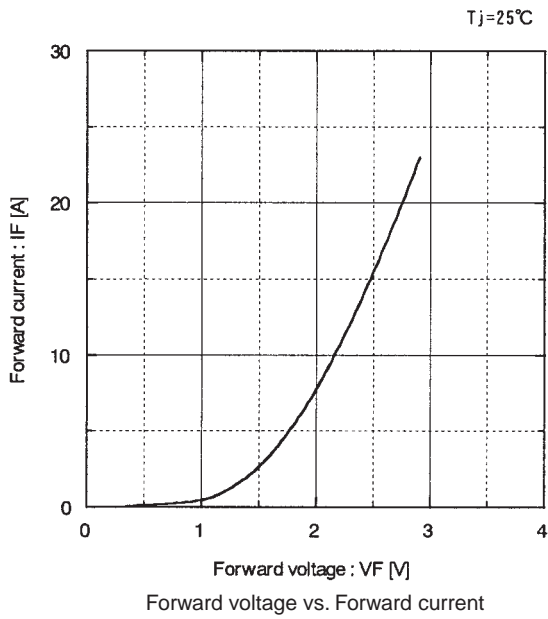
■ Outline drawings, mm



Mass: 50g

■ Characteristics (Representative)





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